

Division Information

Engineer:	Christopher Kester	
Control Engineer:	Stefanie Rucker	
Review Date:	09/18/2014	
Application Date:	07/30/2014	

Facility Identifiers

Permit No.	14WE1298
AIRs	County # 123 Weld
	Facility # 9C99
Facility Type:	exploration and production facility

☒ Located in the 8-hour non-attainment area?☐ True Minor☒ Synthetic Minor for:☒ VOC☒ NOx☒ CO**Administrative Information**

Company Name:	Bonanza Creek Energy Operating Company
Source Name:	State Antelope 14-2 Production Facility
Source Location:	SWSW SEC 2 T5N R62W
SIC:	1311
Mailing Address	Address 1: Bonanza Creek Energy Operating Company
	Address 2: 410 17th Street, Suite 1500
	City, State Zip: Denver, CO 80202
Person To Contact	Name: Peg Young
	Phone: 720-440-6133
	Fax: 720-279-2331
	Email: pyoung@BonanzaCrk.com

Requested Action

Self Certification Required?	Yes
Issuance Number:	1

Source Description:

Oil and gas exploration and production facility known as the State Antelope 14-2 Production Facility, located in the SWSW SEC 2 T5N R62W, Weld County, Colorado.

Point	Name	Type	Control	Action
007	Condensate Tank Battery	Condensate Tanks	Flare	Newly reported source
008	PW Tanks	Water Tanks	Flare	Newly reported source
009	Truck Loadout	Loadout	Flare	Newly reported source
010	FUG	Fugitives	None	Newly reported source
012	FL-2	Separator Venting	Flare	Newly reported source
013	VRT-1	Separator Venting	Flare	Newly reported source
014	P-1	Separator Venting	Flare	Newly reported source
015	Sep-1, Sep-2, and Sep-3	Separator Venting	Flare	Newly reported source

[illegible]

Preliminary Analysis - 09/23/2014 - 14WE1298 - 123/9C99

007

One (1) above ground 300 bbl atmospheric condensate storage tank

Requested Throughput	197100	bbl	Emissions from Combustion (verified)
Control	Flare		Nox 0.1 tpy
Efficiency	95.00%		CO 0.55 tpy

Emissions Summary Table

Pollutant	Emission Factor	Uncontrolled Emissions	Controlled Emissions	Source
VOC	0.5 lb/bbl	49.275 tpy	2.46375 tpy	E&P TANK
Benzene	0.004 lb/bbl	788.4 lb/yr	39.42 lb/yr	E&P TANK
n-Hexane	0.026 lb/bbl	5124.6 lb/yr	256.23 lb/yr	E&P TANK
Toluene	0.00425 lb/bbl	837.675 lb/yr	41.88375 lb/yr	E&P TANK
224 TMP	0.002 lb/bbl	394.2 lb/yr	19.71 lb/yr	E&P TANK

Regulatory Review

Section II.A.1 - Except as provided in paragraphs 2 through 6 below, no owner or operator of a source shall allow or cause the emission into the atmosphere of any air pollutant which is in excess of 20% opacity. This standard is based on 24 consecutive opacity readings taken at 15-second intervals for six minutes. The approved reference test method for visible emissions measurement is EPA Method 9 (40 CFR, Part 60, Appendix A (July, 1992)) in all subsections of Section II. A and B of this regulation.

Section II.A.5 - Smokeless Flare or Flares for the Combustion of Waste Gases No owner or operator of a smokeless flare or other flare for the combustion of waste gases shall allow or cause emissions into the atmosphere of any air pollutant which is in excess of 30% opacity for a period or periods aggregating more than six minutes in any sixty consecutive minutes. (only needed if using flare)

Regulation 2 – Odor

Section I.A - No person, wherever located, shall cause or allow the emission of odorous air contaminants from any single source such as to result in detectable odors which are measured in excess of the following limits: For areas used predominantly for residential or commercial purposes it is a violation if odors are detected after the odorous air has been diluted with seven (7) or more volumes of odor free air.

Regulation 6 - New Source Performance Standards

NSPS Kb: for storage vessels greater than 19,800 gallons after 7/23/84.

This source is not subject because each tank is less than 19,800 gallons (471 bbl)

NSPS OOOO: for storage vessels in the natural gas production, transmission, and processing segments.

This source is not subject because each tank emits less than 6 tpy VOC.

Regulation 7 – Volatile Organic Compounds

XII. VOLATILE ORGANIC COMPOUND EMISSIONS FROM OIL AND GAS OPERATIONS

(Applicant is subject to the emission control requirements for condensate tanks since it is located in an non attainment area.)

XVII.C STATEWIDE CONTROLS FOR OIL AND GAS OPERATIONS...

Subject to these requirements

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008

One (1) above ground 300 bbl produced water storage tank

Emissions Calculations

Requested Throughput	354780	bbl
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Control	Flare
Efficiency	95.00%

Emissions Summary Table

Pollutant	Emission Factor	Uncontrolled Emissions	Controlled Emissions	Source
VOC	0.262 lb/bbl	46.47618 tpy	2.323809 tpy	CDPHE
Benzene	0.007 lb/bbl	2483.46 lb/yr	124.173 lb/yr	CDPHE
n-Hexane	0.022 lb/bbl	7805.16 lb/yr	390.258 lb/yr	CDPHE

Regulatory Review

Section II.A.1 - Except as provided in paragraphs 2 through 6 below, no owner or operator of a source shall allow or cause the emission into the atmosphere of any air pollutant which is in excess of 20% opacity. This standard is based on 24 consecutive opacity readings taken at 15-second intervals for six minutes. The approved reference test method for visible emissions measurement is EPA Method 9 (40 CFR, Part 60, Appendix A (July, 1992)) in all subsections of Section II. A and B of this regulation.

Section II.A.5 - Smokeless Flare or Flares for the Combustion of Waste Gases No owner or operator of a smokeless flare or other flare for the combustion of waste gases shall allow or cause emissions into the atmosphere of any air pollutant which is in excess of 30% opacity for a period or periods aggregating more than six minutes in any sixty consecutive minutes. (only needed if using flare)

Regulation 2 – Odor

Section I.A - No person, wherever located, shall cause or allow the emission of odorous air contaminants from any single source such as to result in detectable odors which are measured in excess of the following limits: For areas used predominantly for residential or commercial purposes it is a violation if odors are detected after the odorous air has been diluted with seven (7) or more volumes of odor free air.

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009

Truck Condensate Loadout

Calculations

 $L = 12.46 * S * P * M / T$ (AP-42: Chapter 5.2, Equation 1)

L = loading losses in lb per 1000 gallons loaded

Factor	Meaning	Value	Units	Source
S	Saturation Factor	1		AP-42
P	True Vapor Pressure	2.48	psia	Sales Oil Analysis
M	Molecular Weight of Vap	59.74	lb/lb-mole	Sales Oil Analysis
T	Liquid Temperature	523.67	deg. R	Field Data

L 3.28 lb/10³ gal
 1.38E-01 lb/bbl

Loading Loss Eq multiplied by VOC wt% of
93.05%

Annual requested Throughput 197100 BBL/yr
 8278200 gal/yr

Annual requested VOC emissions 27154 lb/yr
 13.58 tpy

Control: Flare
Efficiency: 66.50%

NCRPs

Component	Mass Fraction
Benzene	0.0081
n-hexane	0.0541
Toluene	0.0053
Xylenes	0.0014
224 tmp	0.002594

Emissions Summary Table

Pollutant	Emission Factor		Uncontrolled Emissions	Controlled Emissions	Source
VOC	0.1378	lb/bbl	13.58 tpy	4.55 tpy	AP-42
Benzene	0.0011	lb/bbl	219.21 lb/yr	73.44 lb/yr	AP-42
n-Hexane	0.0075	lb/bbl	1470.02 lb/yr	492.46 lb/yr	AP-42
Toluene	0.0007	lb/bbl	142.61 lb/yr	47.77 lb/yr	AP-42
Xylenes	0.0002	lb/bbl	36.66 lb/yr	12.28 lb/yr	AP-42
224 tmp	0.0004	lb/bbl	70.44 lb/yr	23.60 lb/yr	AP-43

Regulatory Review

Regulation 7- Volatile Organic Compounds

This facility is not considered a bulk plant (in Reg. 7) because it does not distribute gasoline.

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010

Fugitive equipment leaks

Regulation 7 Information

Operating Hours: 8760 hours/year

Emission Factor Source Standard EFs - EPA-453/R-95-017 Table 2-4

Control Efficiency Source: None

Calculations

Service	Component Type	Count	Emission Factor (kg/hr-source)		Control (%)	Pollutant	Mass Fraction	Emissions (tpy) Reg. 3
			Table 2-4	Table 2-8				
Gas	Connectors	2282	2.00E-04	1.00E-05	0.0%	VOC	0.2921	10.126744
	Flanges	137	3.90E-04	5.70E-06	0.0%	Benzene	0.000767	0.0265909
	Open-Ended Lines	77	2.00E-03	1.50E-05	0.0%	Toluene	0.00058	0.0201079
	Pump Seals	12	2.40E-03	3.50E-04	0.0%	Ethylbenzene	0.000068	0.0023575
	Valves	333	4.50E-03	2.50E-05	0.0%	Xylenes	0.000191	0.0066217
	Other	159	8.80E-03	1.20E-04	0.0%	n-Hexane	0.004591	0.1591643
Heavy Oil	Connectors	0	7.50E-06	7.50E-06	0.0%	VOC	0	0
	Flanges	0	3.90E-07	3.90E-07	0.0%	Benzene	0	0
	Open-Ended Lines	0	1.40E-04	7.20E-06	0.0%	Toluene	0	0
	Pump Seals	0	0.00E+00	0.00E+00	0.0%	Ethylbenzene	0	0
	Valves	0	8.40E-06	8.40E-06	0.0%	Xylenes	0	0
	Other	0	3.20E-05	3.20E-05	0.0%	n-Hexane	0	0
Light Oil	Connectors	954	2.10E-04	7.50E-06	0.0%	VOC	0.9977	7.0092686
	Flanges	32	1.10E-04	2.40E-06	0.0%	Benzene	0.008179	0.057461
	Open-Ended Lines	8	1.40E-03	1.40E-05	0.0%	Toluene	0.020204	0.1419417
	Pump Seals	0	1.30E-02	5.10E-04	0.0%	Ethylbenzene	0.005187	0.0364409
	Valves	133	2.50E-03	1.90E-05	0.0%	Xylenes	0.020337	0.1428761
	Other	24	7.50E-03	1.10E-04	0.0%	n-Hexane	0.04727	0.3320919
Water/Oil	Connectors	0	1.10E-04	1.00E-05	0.0%	VOC	0	0
	Flanges	0	2.90E-06	2.90E-06	0.0%	Benzene	0	0
	Open-Ended Lines	0	2.50E-04	3.50E-06	0.0%	Toluene	0	0
	Pump Seals	0	2.40E-05	2.40E-05	0.0%	Ethylbenzene	0	0
	Valves	0	9.80E-05	9.70E-06	0.0%	Xylenes	0	0
	Other	0	1.40E-02	5.90E-05	0.0%	n-Hexane	0	0

Emissions Summary Table

Pollutant	Uncontrolled Emissions		Controlled Emissions		Source
VOC	17.14	tpy	17.14	tpy	Standard EFs - EPA-453/R-95-017 Table 2-4
Benzene	168.10	lb/yr	168.10	lb/yr	Standard EFs - EPA-453/R-95-017 Table 2-4
Toluene	324.10	lb/yr	324.10	lb/yr	Standard EFs - EPA-453/R-95-017 Table 2-4
Ethylbenzene	77.60	lb/yr	77.60	lb/yr	Standard EFs - EPA-453/R-95-017 Table 2-4
Xylenes	299.00	lb/yr	299.00	lb/yr	Standard EFs - EPA-453/R-95-017 Table 2-4
n-Hexane	982.51	lb/yr	982.51	lb/yr	Standard EFs - EPA-453/R-95-017 Table 2-4

Regulatory Applicability

Reg. 3	DI&M Will satisfy RACT Requirements
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012	Sales Gas routed to Candlestick Flare in the event of an emergency. Flare has a minimum combustion efficiency of 95%. The flare is enclosed.
FL-2	

Equipment Description

This source vents natural gas from: [a high pressure separator in the event of an emergency \(normally sales gas\)](#)
Emissions from this source are: [routed to a flare](#)

Natural gas venting from a high pressure separator in the event of an emergency (normally sales gas). Emissions from this source are routed to a flare.

Calculations

Emission Calculation Method

EPA Emission Inventory Improvement Program Publication: Volume II, Chapter 10 - Displacement Equation (10.4-3)

$$Ex = Q * MW * Xx / C$$

Ex = emissions of pollutant x

Q = Volumetric flow rate/volume of gas processed

MW = Molecular weight of gas = SG of gas * MW of air

Xx = mass fraction of x in gas

C = molar volume of ideal gas (379 scf/lb-mol) at 60F and 1 atm

Throughput (Q)	15	MMscf/yr	1712.328767	scf/hr
MW	23.3	lb/lb-mol	0.04109589	MMscf/d

	mole %	MW	lbx/lbmol	mass fraction	lb/hr	lb/yr	tpy
Helium	0.01	4.0026	0.000	0.000	0.00	15.84	0.01
CO2	2.56	44.01	1.127	0.048	5.09	44590.61	22.30
N2	0.67	28.013	0.188	0.008	0.85	7428.25	3.71
methane	70.96	16.041	11.382	0.489	51.42	450478.26	225.24
ethane	12.69	30.063	3.815	0.164	17.24	150980.91	75.49
propane	8.19	44.092	3.611	0.155	16.32	142920.90	71.46
isobutane	0.81	58.118	0.472	0.020	2.13	18661.40	9.33
n-butane	2.46	58.118	1.431	0.061	6.47	56653.55	28.33
isopentane	0.44	72.114	0.314	0.013	1.42	12415.41	6.21
n-pentane	0.54	72.114	0.389	0.017	1.76	15397.96	7.70
cyclopentane	0.05	70.13	0.032	0.001	0.14	1249.02	0.62
n-Hexane	0.12	86.18	0.107	0.005	0.48	4239.65	2.12
cyclohexane	0.03	84.16	0.029	0.001	0.13	1135.83	0.57
Other hexanes	0.21	86.18	0.185	0.008	0.83	7305.97	3.65
heptanes	0.11	100.21	0.108	0.005	0.49	4263.55	2.13
methylcyclohexane	0.03	98.19	0.028	0.001	0.13	1115.32	0.56
224-TMP	0.00	114.23	0.000	0.000	0.00	4.52	0.00
Benzene	0.02	78.12	0.018	0.001	0.08	708.03	0.35
Toluene	0.01	92.15	0.014	0.001	0.06	536.12	0.27
Ethylbenzene	0.00	106.17	0.002	0.000	0.01	63.03	0.03
Xylenes	0.00	106.17	0.004	0.000	0.02	176.48	0.09
C8+ Heavies	0.06	137.4837288	0.082	0.004	0.37	3232.14	1.62
99.98 VOC mass fraction:		0.293		Total VOC (Uncontrolled)		135.04	

Notes

Mole %, MW, and mass fractions from Sales gas analysis of Antelope D-X-2HNC.

Emissions are based on 8760 hours of operation per year.

I calculated the average MW of C8+ based on the average MW on the analysis for the gas.

Flaring Information

Equipment Description

Flare to combust produced gas until pipeline is available at this wellhead facility.

Manufacturer	TBD	
Model	TBD	
Serial Number	TBD	
Gas Heating Value	1333	Btu/scf
Throughput	19995	MMBtu/yr

Overall Control	95.00%
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Combustion emission factor source:		AP-42: Chapter 13.5	
0.07	lb NOX/MMBtu	0.37	lb CO/MMBtu

Emissions Summary Table

Pollutant	Uncontrolled Emission Factor	Controlled Emission Factor	Uncontrolled Emissions	Controlled Emissions	Source
VOC	18005.26 lb/MMscf	900.26 lb/MMscf	135.04 tpy	6.75 tpy	Gas Analysis
NOx	0.07 lb/MMBTU	0.07 lb/MMBTU	0.68 tpy	0.68 tpy	AP-42
CO	0.37 lb/MMBTU	0.37 lb/MMBTU	3.70 tpy	3.70 tpy	AP-42
Benzene	47.20 lb/MMscf	2.36 lb/MMscf	708.03 lb/yr	35.40 lb/yr	Gas Analysis
n-Hexane	282.64 lb/MMscf	14.13 lb/MMscf	4239.65 lb/yr	211.98 lb/yr	Gas Analysis
Toluene	35.74 lb/MMscf	1.79 lb/MMscf	536.12 lb/yr	26.81 lb/yr	Gas Analysis
Xylenes	11.77 lb/MMscf	0.59 lb/MMscf	176.48 lb/yr	8.82 lb/yr	Gas Analysis
Ethylbenzene	4.20 lb/MMscf	0.21 lb/MMscf	63.03 lb/yr	3.15 lb/yr	Gas Analysis

Regulatory ApplicabilityAQCC Regulation 1

This source is subject to the opacity requirements for flares in Section II.A.5: 'No owner or operator of a smokeless flare or other flare for the combustion of waste gases shall allow or cause emissions into the atmosphere of any air pollutant which is in excess of 30% opacity.'

AQCC Regulation 2

Section I.A applies to all emission sources. "No person, wherever located, shall cause or allow the emission of odorous air contaminants from any single source such as to result in detectable odors which are measured in excess of the following limits: For areas used predominantly for residential or commercial purposes it is a violation if odors are detected after the odorous air has been diluted with seven (7) or more volumes of odor free air."

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013	Two Enclosed Flares are used to control gas from one (1) Vapor Recovery Tower when the gas compressors are down. Flare has a minimum combustion efficiency of 95%.
VRT-1	

Equipment Description

This source vents natural gas from: [Vapor Recovery Tower when gas compressors are down](#)
Emissions from this source are: [routed to a flare](#)

Natural gas venting from Vapor Recovery Tower when gas compressors are down. Emissions from this source are routed to a flare.

Calculations

Emission Calculation Method

EPA Emission Inventory Improvement Program Publication: Volume II, Chapter 10 - Displacement Equation (10.4-3)

$$Ex = Q * MW * Xx / C$$

Ex = emissions of pollutant x

Q = Volumetric flow rate/volume of gas processed

MW = Molecular weight of gas = SG of gas * MW of air

Xx = mass fraction of x in gas

C = molar volume of ideal gas (379 scf/lb-mol) at 60F and 1 atm

Throughput (Q)	0.848	MMscf/yr	96.80365297	scf/hr
MW	52.3	lb/lb-mol	0.002323288	MMscf/d

	mole %	MW	lbx/lbmol	mass fraction	lb/hr	lb/yr	tpy
Helium	0.00	4.0026	0.000	0.000	0.00	0.00	0.00
CO2	1.27	44.01	0.559	0.011	0.14	1251.66	0.63
N2	0.11	28.013	0.031	0.001	0.01	68.32	0.03
methane	9.11	16.041	1.461	0.028	0.37	3269.69	1.63
ethane	19.46	30.063	5.850	0.112	1.49	13089.76	6.54
propane	26.99	44.092	11.900	0.228	3.04	26626.82	13.31
isobutane	3.47	58.118	2.015	0.039	0.51	4508.39	2.25
n-butane	12.78	58.118	7.428	0.142	1.90	16620.17	8.31
isopentane	2.66	72.114	1.918	0.037	0.49	4291.98	2.15
n-pentane	3.44	72.114	2.481	0.047	0.63	5550.53	2.78
cyclopentane	1.61	70.13	1.132	0.022	0.29	2532.22	1.27
n-Hexane	3.79	86.18	3.266	0.06245	0.83	7308.06	3.65
cyclohexane	1.17	84.16	0.984	0.019	0.25	2202.74	1.10
Other hexanes	7.50	86.18	6.466	0.124	1.65	14467.65	7.23
heptanes	2.75	100.21	2.761	0.053	0.71	6176.72	3.09
methylcyclohexane	0.93	98.19	0.910	0.017	0.23	2036.39	1.02
224-TMP	0.17	114.23	0.196	0.004	0.05	438.23	0.22
Benzene	0.69	78.12	0.539	0.010314	0.14	1206.97	0.60
Toluene	0.48	92.15	0.438	0.008374	0.11	979.89	0.49
Ethylbenzene	0.04	106.17	0.042	0.000807	0.01	94.39	0.05
Xylenes	0.13	106.17	0.143	0.002734	0.04	319.92	0.16
C8+ Heavies	1.44	147	2.120	0.040528	0.54	4742.54	2.37
	100.00		VOC mass fraction	0.855	Total VOC (Uncontrolled)		50.05

Notes

Mole %, MW, and mass fractions from VRT Gas Stream in a ProMax Simulation

Emissions are based on 8760 hours of operation per year.

Flaring Information

Equipment Description

Manufacturer	LEED	
Model	48" L30-0010	
Serial Number	21635 & 21619	
Gas Heating Value	2901	Btu/scf
Throughput	2460.048	MMBtu/yr

Overall Control	95.00%
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Combustion emission factor source:		AP-42: Chapter 13.5	
0.07	lb NOX/MMBtu	0.37	lb CO/MMBtu

Emissions Summary Table

Pollutant	Uncontrolled Emission Factor	Controlled Emission Factor	Uncontrolled Emissions	Controlled Emissions	Source
VOC	118046.72 lb/MMscf	5902.34 lb/MMscf	50.05 tpy	2.50 tpy	ProMax
Nox	0.07 lb/MMBTU	0.07 lb/MMBTU	0.08 tpy	0.08 tpy	AP-42
CO	0.37 lb/MMBTU	0.37 lb/MMBTU	0.46 tpy	0.46 tpy	AP-42
Benzene	1423.31 lb/MMscf	71.17 lb/MMscf	1206.97 lb/yr	60.35 lb/yr	ProMax
n-Hexane	8618.00 lb/MMscf	430.90 lb/MMscf	7308.06 lb/yr	365.40 lb/yr	ProMax
Toluene	1155.53 lb/MMscf	57.78 lb/MMscf	979.89 lb/yr	48.99 lb/yr	ProMax
Xylenes	377.26 lb/MMscf	18.86 lb/MMscf	319.92 lb/yr	16.00 lb/yr	ProMax
Ethylbenzene	111.31 lb/MMscf	5.57 lb/MMscf	94.39 lb/yr	4.72 lb/yr	ProMax
224 tmp	516.80 lb/MMscf	25.84 lb/MMscf	438.25 lb/yr	21.91 lb/yr	ProMax

Regulatory ApplicabilityAQCC Regulation 1

This source is subject to the opacity requirements for flares in Section II.A.5: 'No owner or operator of a smokeless flare or other flare for the combustion of waste gases shall allow or cause emissions into the atmosphere of any air pollutant which is in excess of 30% opacity.'

AQCC Regulation 2

contaminants from any single source such as to result in detectable odors which are measured in excess of the following limits: For areas used predominantly for residential or commercial purposes it is a violation if odors are detected after the odorous air has been diluted with seven (7) or more volumes of odor free air."

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014	One (1) Sandpiper Pnuematic Pump for Water Transfer is controlled by
P-1	

Equipment Description

This source vents natural gas from: [Pnuematic Pump](#)
Emissions from this source are: [routed to a flare](#)

Natural gas venting from Pnuematic Pump. Emissions from this source are routed to a flare.

Calculations

Emission Calculation Method

EPA Emission Inventory Improvement Program Publication: Volume II, Chapter 10 - Displacement Equation (10.4-3)

$$Ex = Q * MW * Xx / C$$

Ex = emissions of pollutant x

Q = Volumetric flow rate/volume of gas processed

MW = Molecular weight of gas = SG of gas * MW of air

Xx = mass fraction of x in gas

C = molar volume of ideal gas (379 scf/lb-mol) at 60F and 1 atm

Throughput (Q)	5.3	MMscf/yr	605.0228311	scf/hr
MW	23.3	lb/lb-mol	0.014520548	MMscf/d

	mole %	MW	lbx/lbmol	mass fraction	lb/hr	lb/yr	tpy
Helium	0.01	4.0026	0.000	0.000	0.00	5.60	0.00
CO2	2.56	44.01	1.127	0.048	1.80	15755.35	7.88
N2	0.67	28.013	0.188	0.008	0.30	2624.65	1.31
methane	70.96	16.041	11.382	0.489	18.17	159168.99	79.58
ethane	12.69	30.063	3.815	0.164	6.09	53346.59	26.67
propane	8.19	44.092	3.611	0.155	5.76	50498.72	25.25
isobutane	0.81	58.118	0.472	0.020	0.75	6593.69	3.30
n-butane	2.46	58.118	1.431	0.061	2.29	20017.59	10.01
isopentane	0.44	72.114	0.314	0.013	0.50	4386.78	2.19
n-pentane	0.54	72.114	0.389	0.017	0.62	5440.61	2.72
cyclopentane	0.05	70.13	0.032	0.001	0.05	441.32	0.22
n-Hexane	0.12	86.18	0.107	0.005	0.17	1498.01	0.75
cyclohexane	0.03	84.16	0.029	0.001	0.05	401.33	0.20
Other hexanes	0.21	86.18	0.185	0.008	0.29	2581.44	1.29
heptanes	0.11	100.21	0.108	0.005	0.17	1506.46	0.75
methylcyclohexane	0.03	98.19	0.028	0.001	0.04	394.08	0.20
224-TMP	0.00	114.23	0.000	0.000	0.00	1.60	0.00
Benzene	0.02	78.12	0.018	0.001	0.03	250.17	0.13
Toluene	0.01	92.15	0.014	0.001	0.02	189.43	0.09
Ethylbenzene	0.00	106.17	0.002	0.000	0.00	22.27	0.01
Xylenes	0.00	106.17	0.004	0.000	0.01	62.36	0.03
C8+ Heavies	0.06	137.4837288	0.082	0.004	0.13	1142.02	0.57
VOC mass fraction:				0.293	Total VOC (Uncontrolled)		47.71

Notes

Mole %, MW, and mass fractions from Sales gas analysis of Antelope D-X-2HNC.

Emissions are based on 8760 hours of operation per year.

I calculated the average MW of C8+ based on the average MW on the analysis for the gas.

Flaring Information

Equipment Description

Flare to combust produced gas until pipeline is available at this wellhead facility.

Manufacturer	LEED	
Model	48" L30-0010	
Serial Number	21635 & 21619	
Gas Heating Value	1333	Btu/scf
Throughput	7064.9	MMBtu/yr

Overall Control	95.00%
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Combustion emission factor source:		AP-42: Chapter 13.5	
0.07	lb NOX/MMBtu	0.37	lb CO/MMBtu

Emissions Summary Table

Pollutant	Uncontrolled Emission Factor	Controlled Emission Factor	Uncontrolled Emissions	Controlled Emissions	Source
VOC	18005.26 lb/MMscf	900.26 lb/MMscf	47.71 tpy	2.39 tpy	Gas Analysis
Nox	0.07 lb/MMBTU	0.07 lb/MMBTU	0.24 tpy	0.24 tpy	AP-42
CO	0.37 lb/MMBTU	0.37 lb/MMBTU	1.31 tpy	1.31 tpy	AP-42
Benzene	47.20 lb/MMscf	2.36 lb/MMscf	250.17 lb/yr	12.51 lb/yr	Gas Analysis
n-Hexane	282.64 lb/MMscf	14.13 lb/MMscf	1498.01 lb/yr	74.90 lb/yr	Gas Analysis
Toluene	35.74 lb/MMscf	1.79 lb/MMscf	189.43 lb/yr	9.47 lb/yr	Gas Analysis
Xylenes	11.77 lb/MMscf	0.59 lb/MMscf	62.36 lb/yr	3.12 lb/yr	Gas Analysis
Ethylbenzene	4.20 lb/MMscf	0.21 lb/MMscf	22.27 lb/yr	1.11 lb/yr	Gas Analysis

Regulatory ApplicabilityAQCC Regulation 1

This source is subject to the opacity requirements for flares in Section II.A.5: "No owner or operator of a smokeless flare or other flare

AQCC Regulation 2

Section I.A applies to all emission sources. "No person, wherever located, shall cause or allow the emission of odorous air contaminants from any single source such as to result in detectable odors which are measured in excess of the following limits: For areas used predominantly for residential or commercial purposes it is a violation if odors are detected after the odorous air has been diluted with seven (7) or more volumes of odor free air."

Preliminary Analysis - 09/23/2014 - 14WE1298 - 123/9C99

015	Separator Emissions routed to enclosed flare when gas compressors are down. Flare has a minimum destruction efficiency of 95%
Sep-1, Sep-2, and Sep-3	

Equipment Description

This source vents natural gas from: [a well head separator](#)
Emissions from this source are: [routed to a flare](#)

Natural gas venting from a well head separator. Emissions from this source are routed to a flare.

Calculations

Emission Calculation Method

EPA Emission Inventory Improvement Program Publication: Volume II, Chapter 10 - Displacement Equation (10.4-3)

$$Ex = Q * MW * Xx / C$$

Ex = emissions of pollutant x

Q = Volumetric flow rate/volume of gas processed

MW = Molecular weight of gas = SG of gas * MW of air

Xx = mass fraction of x in gas

C = molar volume of ideal gas (379 scf/lb-mol) at 60F and 1 atm

Throughput (Q)	5	MMscf/yr	570.7762557	scf/hr
MW	35.4	lb/lb-mol	0.01369863	MMscf/d

	mole %	MW	lbx/lbmol	mass fraction	lb/hr	lb/yr	tpy
Helium	0.01	4.0026	0.000	0.000	0.00	5.28	0.00
CO2	2.83	44.01	1.245	0.035	1.88	16431.17	8.22
N2	0.10	28.013	0.028	0.001	0.04	369.56	0.18
methane	36.60	16.041	5.871	0.166	8.84	77451.58	38.73
ethane	20.11	30.063	6.046	0.171	9.10	79757.77	39.88
propane	20.54	44.092	9.057	0.256	13.64	119483.50	59.74
isobutane	2.63	58.118	1.528	0.043	2.30	20161.89	10.08
n-butane	9.19	58.118	5.342	0.151	8.05	70481.49	35.24
isopentane	2.07	72.114	1.496	0.042	2.25	19738.12	9.87
n-pentane	2.75	72.114	1.982	0.056	2.98	26147.51	13.07
cyclopentane	0.20	70.13	0.141	0.004	0.21	1855.95	0.93
n-Hexane	0.61	86.18	0.524	0.015	0.79	6911.45	3.46
cyclohexane	0.16	84.16	0.137	0.004	0.21	1810.88	0.91
Other hexanes	1.07	86.18	0.923	0.026	1.39	12172.07	6.09
heptanes	0.52	100.21	0.520	0.015	0.78	6857.38	3.43
methylcyclohexane	0.13	98.19	0.128	0.004	0.19	1687.88	0.84
224-TMP	0.00	114.23	0.001	0.000	0.00	19.59	0.01
Benzene	0.12	78.12	0.091	0.003	0.14	1195.50	0.60
Toluene	0.07	92.15	0.062	0.002	0.09	812.09	0.41
Ethylbenzene	0.01	106.17	0.006	0.000	0.01	74.23	0.04
Xylenes	0.01	106.17	0.015	0.000	0.02	191.89	0.10
C8+ Heavies	0.25	137.4837288	0.342	0.010	0.52	4518.10	2.26
		99.98	VOC mass fract	0.630	Total VOC (Uncontrolled)		147.06

Notes

Mole %, MW, and mass fractions from Low Pressure gas analysis of Antelope D-X-2HNC.

Emissions are based on 8760 hours of operation per year.

I calculated the average MW of C8+ based on the average MW on the analysis for the gas.

Flaring Information

Equipment Description

Flare to combust produced gas until pipeline is available at this wellhead facility.

Manufacturer	LEED	
Model	48" L30-0010	
Serial Number	21635 & 21619	
Gas Heating Value	1998 Btu/scf	
Throughput	9990	MMBtu/yr

Overall Control	95.00%
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Combustion emission factor source:	AP-42: Chapter 13.5
0.07 lb NOX/MMBtu	0.37 lb CO/MMBtu

Emissions Summary Table

Pollutant	Uncontrolled Emission Factor	Controlled Emission Factor	Uncontrolled Emissions	Controlled Emissions	Source
VOC	58823.91 lb/MMscf	2941.20 lb/MMscf	147.06 tpy	7.35 tpy	Gas Analysis
Nox	0.07 lb/MMBTU	0.07 lb/MMBTU	0.34 tpy	0.34 tpy	AP-42
CO	0.37 lb/MMBTU	0.37 lb/MMBTU	1.85 tpy	1.85 tpy	AP-42
Benzene	239.10 lb/MMscf	11.96 lb/MMscf	1195.50 lb/yr	59.78 lb/yr	Gas Analysis
n-Hexane	1382.29 lb/MMscf	69.11 lb/MMscf	6911.45 lb/yr	345.57 lb/yr	Gas Analysis
Toluene	162.42 lb/MMscf	8.12 lb/MMscf	812.09 lb/yr	40.60 lb/yr	Gas Analysis
Xylenes	38.38 lb/MMscf	1.92 lb/MMscf	191.89 lb/yr	9.59 lb/yr	Gas Analysis
Ethylbenzene	14.85 lb/MMscf	0.74 lb/MMscf	74.23 lb/yr	3.71 lb/yr	Gas Analysis

Regulatory ApplicabilityAQCC Regulation 1

This source is subject to the opacity requirements for flares in Section II.A.5: 'No owner or operator of a smokeless flare or other flare for the combustion of waste gases shall allow or cause emissions into the atmosphere of any air pollutant which is in excess of 30% opacity.'

AQCC Regulation 2

Section I.A applies to all emission sources. "No person, wherever located, shall cause or allow the emission of odorous air contaminants from any single source such as to result in detectable odors which are measured in excess of the following limits: For areas used predominantly for residential or commercial purposes it is a violation if odors are detected after the odorous air has been diluted with seven (7) or more volumes of odor free air."